

Shapes of molecules

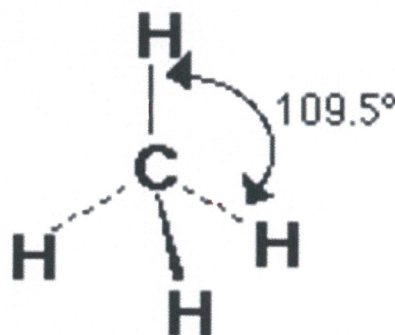
- 1) sketch the Lewis structure
- 2) locate the central atom
- 3) count regions of electron density around the central atom
double/triple bonds and lone pairs count as ONE region of electron density
- 4) determine shape and angle bearing in mind that repulsion varies...
lone pair-lone pair > lone pair-bonding pair > bonding pair-bonding pair



Tetrahedral

- 4 regions of electron density around the central atom, which is carbon
- 4 bonding pairs of electrons around the central atom
- there are no lone pairs of electrons around the central atom
- the regions of electron density are arranged as far as possible from each other, in order to minimise repulsion, making a **TETRAHEDRAL** shape
- With a bond angle of 109°
- eg's SiH_4 , CH_2Br_2 , SO_4^{2-} , PO_4^{3-} , SiCl_4 , CF_4

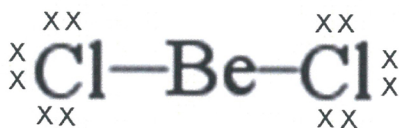
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Linear

- 2 regions of electron density around the central atom, which is Beryllium
- 2 bonding pairs of electrons around the central atom
- there are no lone pairs of electrons around the central atom
- the regions of electron density are arranged as far as possible from each other, in order to minimise repulsion, making a **LINEAR** shape
- bond angle is 180°
- eg's H_2 , HCl , CO_2 , O_2 , CS_2 , N_2 , HOCl , BeCl_2

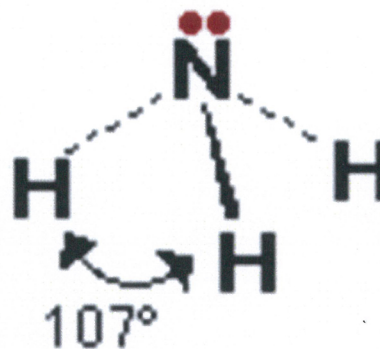
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Trigonal pyramidal

- 4 regions of electron density around the central atom, which is Nitrogen
- 3 bonding pairs of electrons around the central atom
- there is one lone pair of electrons around the central atom
- the bond angle of 107°
(the lone pair of electrons takes up space as if they were a bond, so the arrangement is tetrahedral but because lone pairs repel more than bonding pairs, the bond angle is less than the expected angle of 109°)
- TRIGONAL PYRAMIDAL** shape
- eg's NH_3 , NF_3 , PCl_3 , AsH_3 , AsF_3 , PF_3

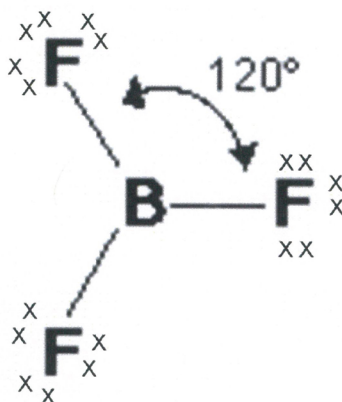
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Trigonal planar

- 3 regions of electron density around the central atom, which is Boron
- 3 bonding pairs of electrons, around the central atom
- there are no lone pairs of electrons, around the central atom
- the regions of electron density are arranged as far as possible from each other, in order to minimise repulsion, making a **TRIGONAL PLANAR** shape
- With a bond angle is 120°
- eg's BCl_3 , BCl_2Br , BClBr_2 , H_2CO , COCl_2 , SO_3

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V-shaped

- 4 regions of electron density around the central atom, which is Oxygen
- 2 bonding pairs of electrons around the central atom
- there are two lone pairs of electrons around the central atom
- the bond angle of 104°
(the two lone pairs of electrons take up space as if they were a bond, so the arrangement is tetrahedral but because lone pairs repel more than bonding pairs, the bond angle is less than the expected angle of 109°)
- V-SHAPE** or **BENT**
- eg's H_2O , OF_2 , SCl_2

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